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Research Notes

Evaluation of #10 and Larger Splices and Headed Bars for use with Grade 80 Reinforcement

Developing QA/QC Criteria and Modifying CT 670 Protocols for #10 and Larger Mechanical Splices and Head Devices with Higher-Strength Grade 80 Bars.

Geotechnical/ Structures

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Project Title: Evaluation of #10 and Larger Splices and Headed Bars for use with Grade 80 Reinforcement

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Task Manager:

Seung Han Kim
Senior Bridge Engineer
seung.h.kim@dot.ca.gov

DRISI Division Chief:

Prakash Sah, PE
Prakash.Sah@dot.ca.gov

WHAT IS THE NEED?

The California Department of Transportation (Caltrans) is preparing to release a Structure Design Alert requiring designers to use ASTM A706 Grade 80 reinforcement, rather than ASTM A706 Grade 60, in capacity protected and non-critical members. The adoption of Grade 80 reinforcement is expected to reduce reinforcement congestion, shorten construction time, decrease material quantities, lower costs, and minimize environmental impacts.

However, the current Authorized Material Lists (AMLs) for couplers and headed bars were developed only for Grade 60 reinforcing bars. To date, no research, testing, or development of Quality Control and Quality Assurance (QC/QA) procedures has been completed to evaluate the performance of couplers and headed bars used with Grade 80 reinforcement. To ensure these elements consistently meet Caltrans' performance requirements, test methods and acceptance criteria must be developed to address the specific risks associated with products currently available for Grade 80 bars in sizes #10 and larger.

WHAT ARE WE DOING?

This research will primarily be experimental. The work will start with a literature review of relevant research and common practices. Then a variety of Grade 80 reinforcement products will be collected from various manufacturers representing the different methods of creating high strength steel. These products will be tested with methods determined from the literature review to find variability of the products and suitability of tests for various types of Grade 80 products. Finally, the results will be used for recommendations on testing

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and acceptance activities of Grade 80 bars sized at or above #10 products for use in Caltrans structures.

Caltrans AMLs for couplers and headed bars are divided into sections based on the coupler design and headed bar connection type respectively. Research testing should include each of the coupler types, and each of the headed bar connection types. Specimens to be tested should be random samples. Yield strength, tensile to yield ratio, and elongation should be measured. The parameter of strain at peak stress should be measured. The location of failure in relation to the coupler/ headed connection should be noted. High strength rebar from different suppliers should be used, and the results for each supplier should be reported separately. Fatigue and cyclic loading will also be performed on each splice type as well using the parameters of the cyclic loading modified from CT 670, section F.

WHAT IS OUR GOAL?

This research aims to develop QC/QA criteria and testing procedures for ASTM A706 Grade 80 couplers and headed bars. This research will also evaluate commercially available couplers and headed bars using the newly developed criteria and testing procedures. This research will also evaluate current CT 670 testing method to develop alterations to criteria and testing for Grade 80 bars sized at or above #10, with emphasis on fatigue and cyclical testing.

WHAT IS THE BENEFIT?

This research will provide new or improved QC/QA testing criteria for ASTM A706 Grade 80 couplers and headed bars, enabling the evaluation of CT 670 that includes new criteria for testing Grade 80 splices. This research will lead to the development the basis for the Approved Materials List for Grade 80 bars sized at or above #10.

WHAT IS THE PROGRESS TO DATE?

The research team has completed several interim reports addressing key components of the project. These include:

- Task 1: A literature review of testing protocols for mechanical splices and headed bars.
- Task 2: Selection and characterization of reinforcing-bar production batches.
- Task 3: Selection of mechanical splice devices and headed bars for testing.
- Task 4: Development of proposed testing protocols for both mechanical splices and headed bars.

The team identified six manufacturers capable of supplying Microalloyed Steel (MA) and Quenching and Self-Tempering (QST) mechanical splice models in sizes #10, #11, #14, and #18 to support 420 scheduled tests, as well as five manufacturers able to provide MA and QST headed bar models in the same size range to support 172 scheduled tests. Comprehensive test protocols have been finalized, including applicable standards, test sequences, key measurement parameters, and instrumentation details.

The testing program is extensive, encompassing more than 400 mechanical splice specimens and over 200 headed bar specimens, with all major manufacturers represented. Physical testing is currently underway. To date, most splice and headed bar specimens have been tested, and individual test results will be compiled into a comprehensive database and evaluated against CT 670 acceptance criteria, adjusted for Grade 80 reinforcement.

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IMAGES

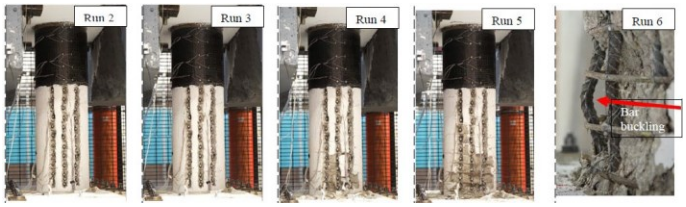

Image 1: Zapscrewlock (ZXFA) Shear Screw Coupler Test Specimen

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